MilkoMotion

1. Pour about ¼ of an inch of milk into the plate – at least enough to cover the bottom. (Room temperature milk works best.)

2. Add 5 or 6 drops of food color randomly spread around the plate of milk. Do not stir!

3. Carefully add a drop of dishwashing liquid (anywhere) to the milk. Watch what happens!!

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From Steve Spangler Science (http://www.stevespanglerscience.com/experiment/00000066 )

**How does it work?** Milk is mostly water but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended in solution. Fats and proteins are sensitive to changes in the surrounding solution (the milk). When you add soap, the weak chemical bonds that hold the proteins in solution are altered. It's a free for all! The molecules of protein and fat bend, roll, twist, and contort in all directions. The food color molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. At the same time, soap molecules combine to form a micelle, or cluster of soap molecules. These micelles distribute the fat in the milk. This rapidly mixing fat and soap causes swirling and churning where a micelle meets a fat droplet. When there are micelles and fat droplets everywhere the motion stops, but not until after you've enjoyed the show!

There's another reason the colors explode the way they do. Since milk is mostly water, it has surface tension like water. The drops of food coloring floating on the surface tend to stay put. Liquid soap wrecks the surface tension by breaking the cohesive bonds between water molecules and allowing the colors to zing throughout the milk. What a party!

Repeat the experiment using water in place of milk. Will you get the same eruption of color? Why or why not? What kind of milk produces the best swirling of color: skim, 1%, 2%, or whole milk? Why?

**Additional Info** Detergent, because of its bipolar characteristics (hydrophilic on one end and hydrophobic on the other), weakens the milk's bonds by attaching to its fat molecules. The detergent's hydrophilic end dissolves in water and its water-fearing end attaches to a fat globule in the milk.

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